Revista Mexicana de Ortodoncia

Vol. 2, No. 3 ● July-September 2014
pp 183-187

ORIGINAL RESEARCH

Resistance to traction forces in mini-implants used in Ortohodontics depending on the insertion angle

Resistencia a fuerzas de tracción de miniimplantes usados en ortodoncia dependiendo del ángulo de inserción

Oscar Iniestra Iturbe,* Enrique Grageda Núñez,§ Carlos Álvarez Gayosso,II
Jorge Guerrero IbarraII

ABSTRACT

For maximum anchorage in orthodontics, mini-implants have been used for various tooth movements without causing unwanted reactive forces on the teeth. The purpose of this study was to evaluate the mechanical resistance to traction of mini-implants to be evicted from bone and assess whether they can increase their tensile strength depending on its insertion angle (60 and 90º). Pig hip cuts were used for the placement of 5 mini-implants which were inserted with a 60º angulation and a 90º angulation. Ten new 2.5 mm (neck) x 1.6 (diameter) x 8 mm (length) with flat head self- drilling mini-implants were used (MOSAS Dewimed. Germany). They were subjected to perpendicular tensile forces, using a universal mechanical testing machine (Instron) with a loading rate of 1 mm/min. The results were analyzed using *Student's* t test. It was observed that 90º angulation mini-implants had better resistance (7.40 ± 2.68 Mpa) than 60º angulation ones (4.21 ± 0.58 Mpa). 90º angulation mini-implants could be a better option for orthodontic treatment due to their higher resistance to traction forces thus improving stability.

RESUMEN

Para obtener un anclaje máximo en ortodoncia, se cuenta con el uso de miniimplantes para realizar distintos movimientos dentales sin que se produzcan fuerzas reactivas no deseadas en los dientes. El objetivo de este estudio fue valorar la resistencia mecánica a fuerzas de tracción de los miniimplantes al ser desalojados del hueso, así como evaluar si éstos pueden aumentar su resistencia a la tracción dependiendo del ángulo de inserción (60 y 90º). Se utilizaron cortes de cadera de cerdo, en los cuales se insertaron 5 miniimplantes con angulación de 60º y 5 con angulación de 90º. Se utilizaron 10 miniimplantes autorroscables nuevos de 2.5 mm (cuello) x 1.6 (diámetro) x 8 mm (longitud) con cabeza plana marca Dewimed MOSAS, Germany. Se sometieron a fuerzas de tracción perpendiculares a éstos, usando una máquina universal de pruebas mecánicas (Instron) con una velocidad de carga de 1 mm/min. Después de realizar el análisis estadístico por medio de *t* de *Student*, se observó que los miniimplantes colocados con angulación de 90º y perpendiculares a la cortical, soportaron mayor resistencia (7.40 ± 2.68 MPa) que los miniimplantes a 60º (4.21 ± 0.58 MPa). Podrían ser los miniimplantes colocados a 90º una mejor opción en los tratamientos de ortodoncia por su mayor resistencia a las fuerzas y, por lo tanto, mejorar la estabilidad.

Key words: Anchorage, miniscrews, tensile strenght.
Palabras clave: Anclaje, miniimplantes, resistencia a la tracción.

INTRODUCTION

The need of anchorage in orthodontics occurs when teeth natural movements are produced in larger proportions; they must be secured against an anchor which, if possible, should be fixed.[1-3] With each application of a dental force, reactive forces will be produced which cause, according to the Third Law of Newton, tooth movements in an opposite direction that in most cases, are unwanted.[4] Anchorage can be defined as the resistance that a body presents to be displaced;[1] in orthodontic terms, the body represents the tooth and the displacement is performed by means of forces which can be light and continuous or heavy and intermittent.[5]

* Graduated from the Orthodontics Department at the Postgraduate Studies and Research Division of the Faculty of Dentistry of the National Autonomous University of Mexico.
§ Professor of the Orthodontics Department at the Postgraduate Studies and Research Division of the Faculty of Dentistry of the National Autonomous University of Mexico.
II Dental Materials Laboratory, Postgraduate Studies and Research Division of the Faculty of Dentistry of the National Autonomous University of Mexico.

This article can be read in its full version in the following page:
http://**www.medigraphic.com/ortodoncia**

In orthodontics there are three types of anchorage: minimal, moderate and maximum or absolute. The latter is one of the most widely used, because thanks to it, a minimum of space is lost from an extraction performed to get the space that dental crowding demands.[6]

Therefore, alternatives have been sought in relation to absolute anchorage where a minimum cooperation from the patient is required, but above all, that the presence of other teeth as anchorage is not required. That is how implants of mini-screw or mini-implants emerged, to be used as maximum anchorage and meet the above mentioned requirements.[3]

Mini-implants were introduced in orthodontics in 1945, as mentioned by Papadapolus,[1] by placing screws of vitallium in the ascending ramus of the mandible of dogs. From then on, they have been used as temporary anchorage for:

- Canine retraction.
- Retraction of the anterior segment.
- Dental Intrusion.
- Distalization.
- Mesialization.[7]

The success of mini-implants depends on several factors that directly influence their stability,[8] such as:

- Cortical bone (quantity and quality).
- Type of implant (diameter, length and shape).
- Implant position (angle).
- Gingival tissue around the implant.
- Age of the patient (the amount and quality of bone increases with age).[7]
- Force applied (clinical reports suggest that mini-implants are stable with forces of 50 g (0.5 N) to 450 g (4.5 N).[7-9]

This study aimed to assess the amount of traction force that mini-implants can withstand placed in bone with two different angulations until its eviction or fracture. In the present study, we chose angulations of 60 and 90º for comparison and to observe which presented the greatest resistance to tensile forces.

MATERIALS AND METHODS

10 new 2.5 mm (neck) x 1.6 (diameter) x 8 mm (length) flat head (Dewimed MOSAS Germany, *Figure 1*) self- drilling mini-implants were used and placed in cuts of pork hip, with a 2 mm thick cortical, on a type IV plaster base. The purpose of the base was to keep the sample with the mini-implant oriented perpendicular to the force direction *(Figure 2)*.

The samples were placed in 10% formalin for its conservation.

The sample was divided in 2 groups: 5 with an insertion angle of 60º and 5 with angle of 90º. The 10 mini-implants were placed using an air-rotor (Steri-oss LP01-1036 Rev) with a handpiece with a rotation of 20:1 to 100% (minimum speed of 300 and a maximum of 1500 RPM). A protractor was used to guide the mini-implants to their respective angulation *(Figure 3)*. The hip-plaster-bone set was placed in a universal machine for mechanical testing (Instron 5567). An 0.012 -inch stainless steel wire was introduced through the hole

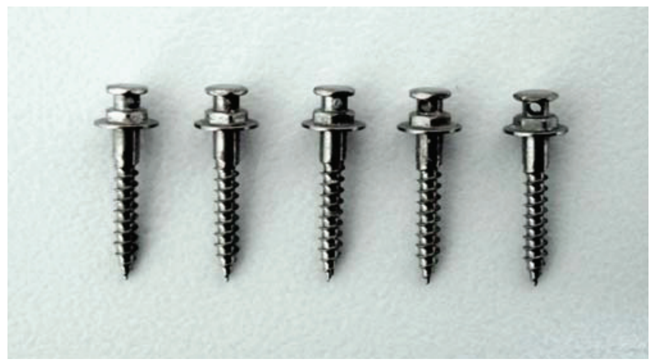

Figure 1. Self-drilling mini-implants.

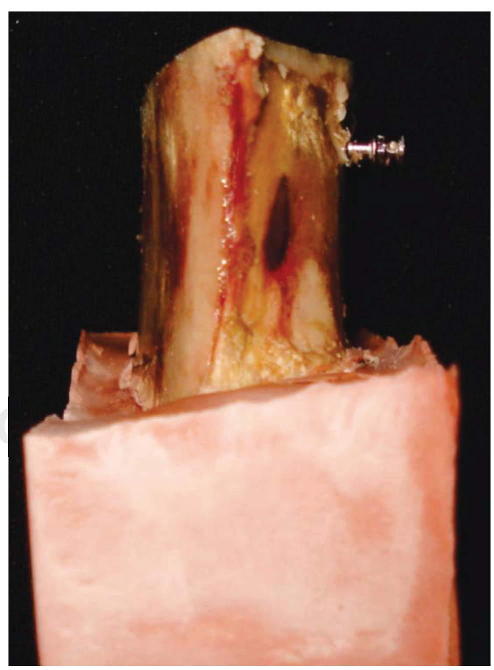

Figure 2. Sample with the mini-implant perpendicular to the force direction.